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10/572,525	10/26/2007	Xuejun Kang	007989.P002	4632

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BLAKELY SOKOLOFF TAYLOR & ZAFMAN LLP  
1279 OAKMEAD PARKWAY  
SUNNYVALE, CA 94085-4040

EXAMINER
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NGUYEN, KHIEM D

ART UNIT	PAPER NUMBER
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2823

MAIL DATE	DELIVERY MODE
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11/25/2009

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/572,525	<b>Applicant(s)</b> KANG ET AL.	
	<b>Examiner</b> KHIEM D. NGUYEN	<b>Art Unit</b> 2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 29 July 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

4) ☒ Claim(s) 1-3, 5, 9, 11-13, 15, 18, 19, 21, 23-26, 28-31, 33, 35-38, 40-43, 45, 46, and 49- 52 is/are pending in the application.

4a) Of the above claim(s) 29-31, 33, 35-38, 40-43, 45, 46 and 49-52 is/are withdrawn from consideration.

- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3, 5, 9, 11-13, 15, 18, 19, 21, 23-26 and 28 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>07/29/2009</u> . | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Remarks*

1. The Amendment filed on July 29<sup>th</sup>, 2009 is acknowledged. By this amendment, claims 1-3, 5, 9, 11, 15, 18, 19, 21, 23-26 and 28 have been amended and claim 27 and 47-48 have been cancelled. Accordingly, claims 1-3,5,9,11-13,15,18,19,21,23-26, 28-31,33,35-38,40-43, 45-46, and 49-52 are pending in this application in which claims 29-31, 33, 35-38, 40-43, 45, 46 and 49-52 have been withdrawn from further consideration as being drawn to non-elected invention.
2. Applicants' amendment to claim 19 had obviated the claim objection in the previous Office Action.

### ***Claim Rejections - 35 USC § 102***

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

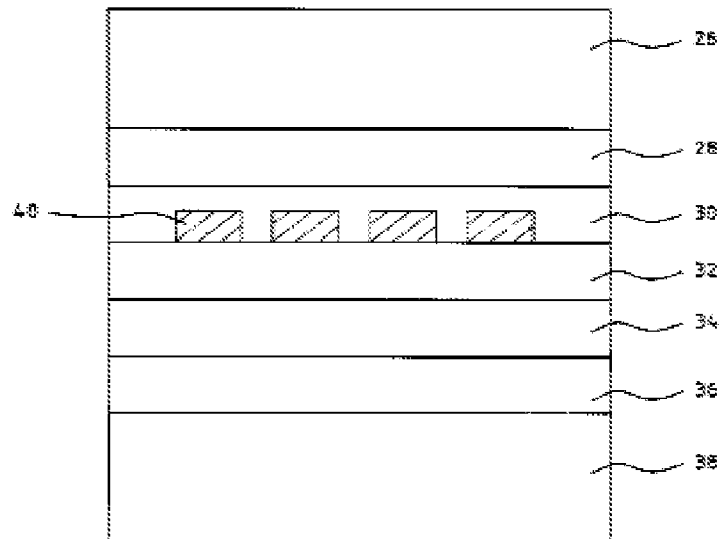
(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1-3, 9, 11-13, 15, 18, 19, 21, 23-26, and 28 are rejected under 35 U.S.C. 102(e) as being anticipated by Yang et al. (U.S. Patent 6,649,437).

In re claim 1, **Yang et al.** disclose a method for fabrication of a semiconductor device, the method including:

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(a) providing a wafer comprising a substrate **38** with multiple epitaxial layers **32, 34, 36** mounted on a substrate **38**, the multiple epitaxial layers **32, 34, 36** comprising an active region where light is able to be generated (see col. 2, lines 32-52 and FIG. 1);

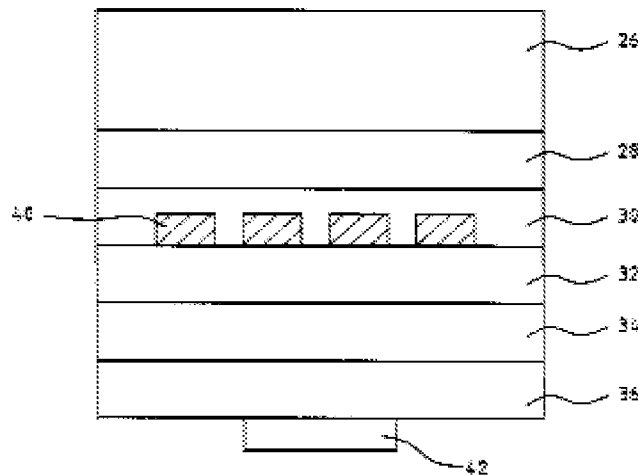
**FIG. 1**

(b) forming a first ohmic contact layer **28, 30, 40** on a first surface of the multiple epitaxial layers **32, 34, 36**, the first surface being remote from the substrate **38**, the first ohmic contact layer comprising multiple metal layers **28, 30, 40** and being a mirror (see col. 2, lines 52-64 and FIG. 1);

(c) forming a relatively thick layer of a thermally conductive metal **26** adjacent to the first ohmic contact layer **28, 30, 40**, the thermally conductive

metal **28** being of sufficient thickness to provide a heat sink (see 3, lines 5-10 and FIG. 1); and

(d) removing the substrate **38** (see col. 3, lines 11-21 and FIG. 2).



**FIG. 2**

In re claim 2, as applied to claim 1 above, **Yang et al.** disclose all claimed limitations including the limitation wherein the first ohmic contact layer is coated with an adhesion layer prior to application of a seed layer of thermally conductive metal, and wherein the relatively thick layer is formed on the seed layer by electroplating (see col. 2, line 42 to col. 3, line 10 and FIG. 1).

In re claim 3, as applied to claim 2 above, **Yang et al.** disclose all claimed limitations including the limitation wherein the seed layer **28** is patterned with photoresist patterns before the electroplating step, and the electroplating of the

relatively thick layer **26** is between the photoresist patterns (see col. 2, lines 42-64 and FIG. 1).

In re claim 9, as applied to claim 2 above, **Yang et al.** disclose all claimed limitations including the limitation wherein the seed layer **28** is electroplated without patterning, patterning being performed subsequently by photoresist patterning and then wet etching (see col. 2, lines 42-64 and FIG. 1).

In re claim 11, as applied to claim 9 above, **Yang et al.** disclose all claimed limitations including the limitation wherein patterning is by laser beam micro-machining of the relatively thick layer **26** (see col. 2, lines 42-64 and FIG. 1).

In re claim 12, as applied to claim 3 above, **Yang et al.** disclose all claimed limitations including the limitation wherein the relatively thick layer is of a height no greater than the photoresist height (see col. 2, lines 42-64 and FIG. 1).

In re claim 13, as applied to claim 3 above, **Yang et al.** disclose all claimed limitations including the limitation wherein the relatively thick layer of thermally conductive metal **26** is electroplated to a height greater than the photoresist and is subsequently thinned, thinning being by polishing or wet etching (see col. 3, lines 2-21).

In re claim 15, as applied to claim 1 above, **Yang et al.** disclose all claimed limitations including the limitation wherein after step (d) there is included an extra step of forming on a second surface (bottom surface) of the multiple epitaxial layers a second ohmic contact layer **42**, the second ohmic contact layer

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**42** being selected from the group consisting of: opaque, transparent, and semi-transparent, the second ohmic contact layer being one of blank and patterned, bonding pads being formed on the second ohmic contact layer (see col. 3, lines 11-21 and FIG. 2).

In re claim 18, as applied to claim 1 above, **Yang et al.** disclose all claimed limitations including the limitation wherein after step (d) ohmic contact formation and subsequent process steps are carried out, the subsequent process steps including deposition of wire bond pads (see col. 3, lines 3-21 and FIG. 2).

In re claim 19, as applied to claim 15 above, **Yang et al.** disclose all claimed limitations including the limitation wherein the second surface is cleaned and etched before the second ohmic contact layer is deposited, the second ohmic contact layer **42** not covering the whole area of the second surface (see col. 3, lines 11-21 and FIG. 1).

In re claim 21, as applied to claim 15 above, **Yang et al.** disclose all claimed limitations including the limitation wherein a plurality of semiconductor devices are fabricated on the wafer, and wherein after forming the second ohmic contact layer **42** there is included testing of the semiconductor devices on the wafer and separating the layers into individual devices (see col. 3, lines 11-21 and FIG. 2).

In re claim 23, as applied to claim 1 above, **Yang et al.** disclose all claimed limitations including the limitation wherein a plurality of semiconductor devices are fabricated on the wafer without one or more selected from the group

consisting of: lapping, polishing and dicing (see col. 2, line 42 to col. 3, line 21 and FIGS. 1-2).

In re claim 24, as applied to claim 1 above, **Yang et al.** disclose all claimed limitations including the limitation wherein the first ohmic contact layer is on p-type layers of the multiple epitaxial layers (see col. 2, lines 42-64 and FIG. 1).

In re claim 25, as applied to claim 24 above, **Yang et al.** disclose all claimed limitations including the limitation wherein the second ohmic contact layer **42** is formed on n-type layers of the multiple expitaxial layers **32, 34, 36** (see col. 2, lines 42-64 and FIG. 1).

In re claim 26, as applied to claim 1 above, **Yang et al.** disclose all claimed limitations including the limitation wherein after step (d), dielectric films are deposited on the multiple epitaxial layers and openings are cut in the dielectric films and second ohmic contact layer **42** and bond pads deposited on the multiple epitaxial layers (see col. 2, lines 42-64 and FIG. 1).

In re claim 28, as applied to claim 1 above, **Yang et al.** disclose all claimed limitations including the limitation wherein the thermally conductive metal comprises copper (see col. 3, lines 3-10) and the multiple epitaxial layers **32, 34, 36** comprise multiple GaN-related layers (see col. 2, lines 41-64).

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:



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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yang et al. (U.S. Patent 6,649,437).

In re claim 5, as applied to claim 3 paragraph 4 above, Yang et al. discloses wherein between steps (c) and (d) there is performed the additional step of annealing the layers to improve adhesion, and the photoresist patterns are of a predetermined height, a predetermined thickness range, and a predetermined spacing range (see col. 2, lines 42-64 and FIG. 1) but do not specifically disclose wherein the photoresist patterns are of a height in the range 15 to 500 micrometers, a thickness in the range 3 to 500 micrometers, and a spacing in the range of 200 to 2,000 microns.

However, there is no evidence indicating the height, thickness, and spacing of the photoresist patterns is critical and it has been held that it is not inventive to discover the optimum or workable range of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05. Note that the specification contains no disclosure of either the critical nature of the claimed dimensions of any unexpected results arising there from. Where patentability is aid to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

***Response to Applicants' Amendment and Arguments***

7. Applicants' arguments filed July 29<sup>th</sup>, 2009 have been fully considered but they are not persuasive.

Applicants contend that the reference, Yang et al. (U.S. Patent 6,649,437), herein known as **Yang**, fails to disclose the following limitation of amended claim 1, "forming a first ohmic contact layer on a first surface of the multiple epitaxial layers, the first surface being remote from the substrate, the first ohmic contact layer comprising multiple metal layers and being a mirror".

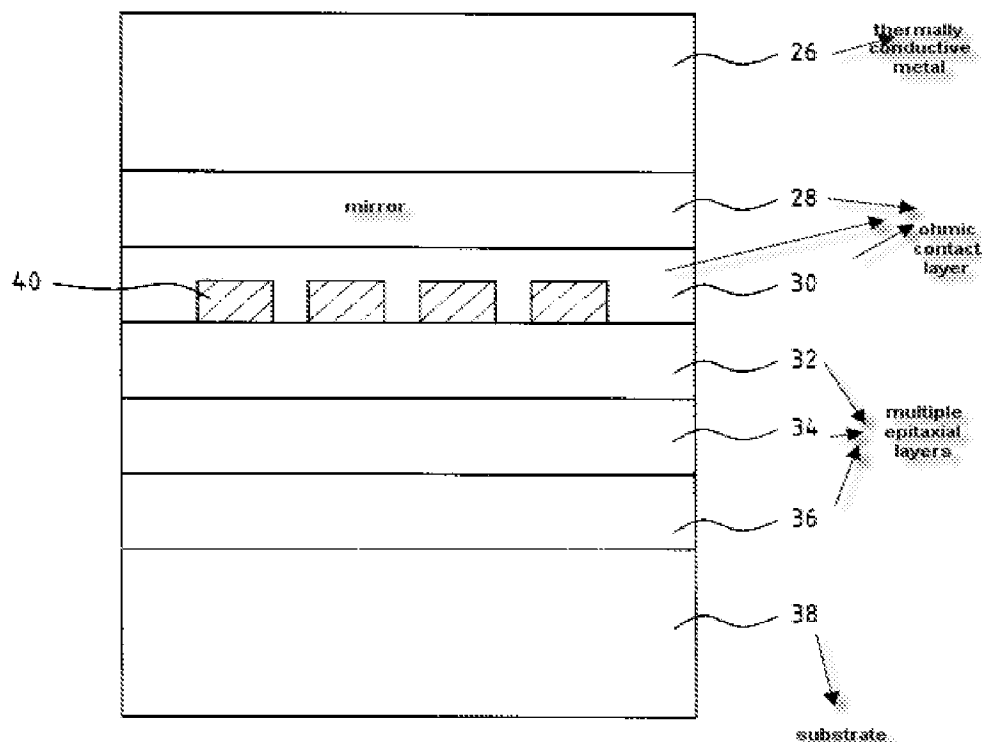
In response to Applicants' contention that **Yang** does not teach or suggest forming a first ohmic contact layer on a first surface of the multiple epitaxial layers, the first surface being remote from the substrate, the first ohmic contact layer comprising multiple metal layers and being a mirror, Examiner respectfully disagrees.

Applicants' attention is respectfully directed to (col. 2, lines 52-64 and FIG. 1) where **Yang** clearly discloses forming a first ohmic contact layer 28, 30, 40 on a first surface of the multiple epitaxial layers 32, 34, 36, the first surface being remote from the substrate 38, the first ohmic contact layer comprising multiple metal layers 28, 30, 40 and being a mirror.

It is respectfully submitted that the first ohmic contact layer comprising multiple metal layers 28, 30, 40 in which layer 28 being a mirror. **Yang** specifically discloses in (col. 2, lines 57-64) that , "a metal reflection layer 28 is used to reflect the light emitted from the active layer 34 before it is absorbed by

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the metal substrate layer 26. The metal reflection layer 28 should have a reflection rate higher than 80% to effectively reflect the light emitted from the active layer 34. For visible lights, metals such as silver, aluminum, and gold all have high reflection rate are suitable candidate material for the metal reflection 28". Thus, **Yang** discloses that the first ohmic contact layer comprising multiple metal layers and being a mirror (see marked-up version of FIG. 1 as illustrated below).

**FIG. 1**

For this reason, Examiner holds the rejection proper.

***Conclusion***

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

***Correspondence***

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KHIEM D. NGUYEN whose telephone number is (571)272-1865. The examiner can normally be reached on Monday-Friday (9:00 AM - 6:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew S. Smith can be reached on (571) 272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Khiem D. Nguyen/  
Primary Examiner, Art Unit 2823  
November 19<sup>th</sup>, 2009